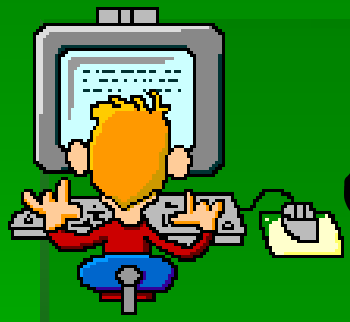
Work, Power, & Machines

What is work ?



- The product of the force applied to an object and the distance through which that force is applied.

Is work being done or not?

- Mowing the lawn — YES
- Weight-lifting — YES
- Moving furniture up a flight of stairs — YES
- Pushing against a locked door — NO
- Swinging a golf club — YES

Calculating Work

work = force x distance

- All or part of the force must act in the direction of the movement.

Do you do more work when you finish a job quickly?

- Work does NOT involve time, only force and distance.
- No work is done when you stand in place holding an object.
- Labeling work: $W = F \times d$

The Joule

- 1 newton-meter is a quantity known as a *joule* (J).
- Named after British physicist James Prescott Joule.

Power

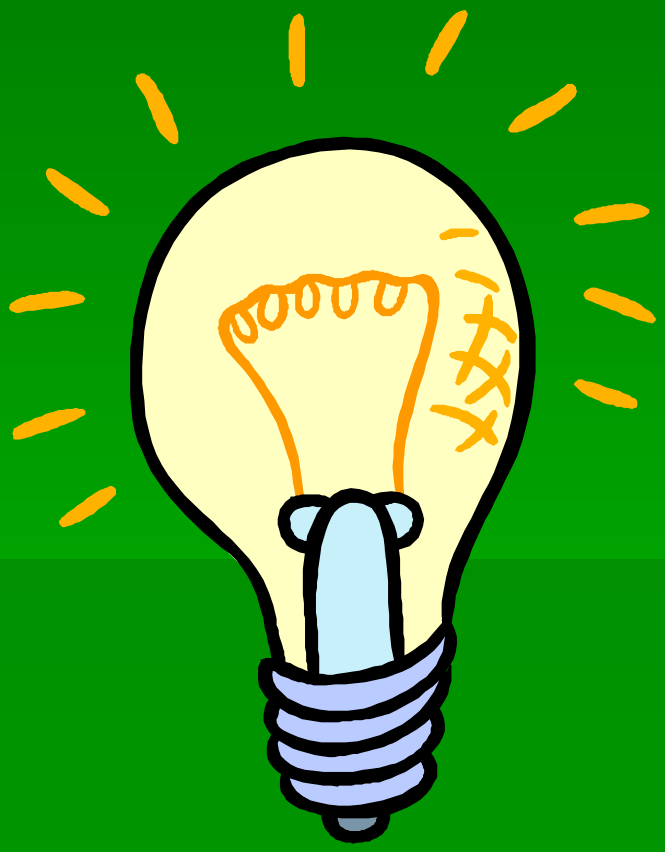
- How quickly work is done.
- Amount of work done per unit time.
- If two people mow two lawns of equal size and one does the job in half the time, who did more work?
- Same work. Different power exerted.
- POWER = WORK / TIME

The watt

- A unit named after Scottish inventor James Watt.
- Invented the steam engine.
- P = W/t
  - Joules/second
  - 1 watt = 1 J/s

watts

- Used to measure power of light bulbs and small appliances
- An electric bill is measured in kW/hrs.
- 1 kilowatt = 1000 W



Horsepower (hp)

- Traditionally associated with engines. (car, motorcycle, lawn-mower)
- The term *horsepower* was developed to quantify power. A strong horse could move a 750 N object one meter in one second.
- Equivalents:
  - 1 hp = 745.5
  - 1 hp = 550 ft-lbs/sec